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CLAIMS

What is claimed is:

- 1 1. A process for fabricating an interconnect structure on an electronic device
2 with copper conductor substantially free of internal seams or voids which comprises:
3 forming an insulating material on a substrate;
4 lithographically defining and forming recesses for lines and/or vias in the
5 insulating material in which interconnection conductor material will be deposited;
6 depositing a barrier layer against copper diffusion;
7 depositing a current carrying copper seed layer;
8 depositing the copper conductor by electroplating from a bath containing a
9 dissolved cupric salt wherein the concentration of the cupric salt is at least about 0.4
10 molar and an acid and wherein the bath has an acidic pH.
- 1 2. The process of claim 1 wherein the concentration of the cupric salt is at
2 least about 0.8 molar.
- 1 3. The process of claim 1 wherein the cupric salt comprises CuSO_4 .
- 1 4. The process of claim 1 wherein the concentration of the acid is an amount
2 up to about 0.5 molar.
- 1 5. The process of claim 1 wherein the concentration of the acid is about 0.1
2 to about 0.25 molar.
- 1 6. The process of claim 4 wherein the acid is sulfuric acid.
- 1 7. The process of claim 1 wherein the electroplating bath has a pH of up to
2 about 5.

1 8. The process of claim 1 wherein the electroplating bath has a pH of about
2 0.6.

1 9. The process of claim 1 wherein the electroplating bath contains at least
2 one auxiliary additive selected from the group consisting of brightener, leveling agent,
3 ductility enhancer and stress reducer.

1 10. The process of claim 1 wherein the electroplating bath is free of
2 complexing agents.

1 11. The process of claim 1 wherein the substrate is coupled to a plating power
2 supply with the current enabled before introducing the substrate into the bath.

1 12. The process of claim 11 wherein the initial current of the power supply is
2 lower than the current of the electroplating of copper from the bath onto the substrate.

1 13. The process of claim 12 wherein the initial current is maintained for up to
2 about 40 seconds.

1 14. The process of claim 1 wherein the electroplating is carried out at a current
2 density of about 10 to about 50 mA/cm².

1 15. The process of claim 13 wherein the initial current is about 1-5 mA/cm².

1 16. The process of claim 1 which further comprises depositing a barrier layer
2 on sidewalls and bottom surfaces of the lines or vias, and depositing a metal seed layer
3 prior to electroplating the copper.

1 17. The process of claim 16 wherein the metal seed layer is copper.

1 18. The method of claim 1 wherein the vias or lines have dimensions of about
2 0.275 μm or less and aspect ratios of at least about 3.

1 19. The method of claim 1 which further comprises planarizing or chemical-
2 mechanical polishing after the electroplating.

1 20. A copper damascene structure having an aspect ratio of greater than about
2 3 and a width of less than about 0.275 μm which comprises:
3 a substrate having a dielectric layer having a via and/or line opening therein;
4 the via and/or line opening having a liner or barrier layer on sidewalls and bottom
5 surfaces of the via opening;
6 a metal seed layer on the liner or barrier layer; and
7 wherein the via and/or line opening is filled with electroplated copper that forms a
8 continuous interface with the liner or barrier layer and being substantially free of internal
9 seams or voids.

1 21. An interconnect structure obtained by the process of claim 1.

1 22. An electroplating copper bath comprising dissolved cupric salt at a
2 concentration of at least about 0.4 molar, up to about 0.5 molar concentration of an acid
3 and having an acidic pH.

1 23. The bath of claim 22 being free of complexing agent.

1 24. The bath of claim 23 wherein the cupric salt concentration is at least about
2 0.8 molar.